

CLAIMS

What is claimed is:

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1. A device, comprising:

a substrate;

an active region having a bottom and a top surface, wherein the active region is disposed at its bottom surface on the substrate and the active region is for emitting light generated therein out of its top surface; and

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a heat-spreading layer disposed on a surface of the active region and in contact with material outside the active region, for removing heat from the active region.

2. The device of claim 1, wherein the heat-spreading layer is disposed directly on the top surface of the active region.

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3. The device of claim 2, wherein the heat-spreading layer has a thickness between about 1 μm and 4 μm .

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4. The device of claim 3, wherein the heat-spreading layer consists of InP.

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5. The device of claim 1, further comprising a bottom mirror disposed on the substrate, wherein the active region is disposed on the bottom mirror.

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6. The device of claim 5, wherein the heat-spreading layer is disposed directly on the bottom surface of the active region, between the active region and the bottom mirror.

7. The device of claim 5, further comprising a top mirror disposed on the active region such that the active region is interposed between the first reflector and the second reflector, wherein the device is a laser device.

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8. The device of claim 7, wherein the heat-spreading layer is disposed directly on the top surface of the active region, between the active region and the top mirror.

9. The device of claim 8, further comprising a second heat-spreading layer disposed on the bottom surface of the active region, between the active region and the bottom mirror.

10. The device of claim 8, wherein the heat-spreading layer has a thickness between about 1 μm and 4 μm .

11. The device of claim 10, wherein the heat-spreading layer consists of InP.

12. The device of claim 8, further comprising an active region layer comprising the active region and active region layer portions outside the active region, wherein the heat-spreading layer is disposed on the top surface of the active region and on a top surface of the active region layer portions outside the active region.

13. The device of claim 8, wherein the top mirror comprises a top distributed Bragg reflector (DBR) and the bottom mirror comprises a bottom DBR.

14. The device of claim 8, wherein:
the top and bottom DBRs are for at least partially reflecting light at a wavelength and the active region is for generating light at the wavelength; and
the heat-spreading layer is substantially transparent to light at the wavelength.

15. The device of claim 13, wherein the top DBR comprises a dielectric top DBR and the bottom DBR comprises a semiconductor bottom DBR, wherein the heat-spreading layer has a thermal conductivity greater than that of the top DBR and greater than that of the bottom DBR.

16. The device of claim 8, wherein the active region is adapted to be optically pumped.

17. The device of claim 16, wherein the top mirror is mounted above the heat-spreading layer with a gap between, wherein the bottom mirror, active region, top mirror, and heat-spreading layer form a vertical external-cavity surface-emitting laser.

5 18. The device of claim 8, wherein the active region is adapted to be electrically pumped.

19. The device of claim 7, wherein the heat-spreading layer is disposed on the bottom surface of the active region, between the active region and the bottom mirror.

10 20. The device of claim 1, wherein the active region is one of an array of active regions, each active region of the array being disposed at its bottom surface on the substrate and having the heat-spreading layer disposed on a surface of said each active region.

21. A device, comprising:

gain means for emitting light generated therein out of a top surface of the gain means;

and

heat-spreading means disposed on a surface of the gain means for removing heat from the active region.

22. A device, comprising:

a non-section-112(6) gain means for emitting light generated therein out of a top surface of the gain means; and

a non-section-112(6) heat-spreading means disposed on a surface of the gain means for removing heat from the active region.

23. A method for removing heat from an active region of a device, comprising the steps of:

generating light with the active region and emitting said light out of a top surface of the active region; and

removing heat from the active region with a heat-spreading layer disposed on a surface of the active region and in contact with material outside the active region.